A study of the associative behaviour of the fish *Amphiprion polymnus* (Linn.) and Sea Anemone *Stoichactis giganteum* (Forsk.)[1]

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Though sea anemones are known to prey upon fishes of many species by means of the venomous nematocysts covering their tentacles (Gudger 1941; Mariscal 1966a), several species of *Amphiprion* live in intimate association with the anemones throughout life. A summary of reported associations of *Amphiprion* with sea anemones has been given by Mariscal (1972). Day (1878) reported the fish *Amphiprion percula* in association with the sea anemone *Actinia* sp. at Andaman Islands. Mahadevan & Nayar (1965) were the first to describe an association of *Amphiprion sebae* with the giant sea anemone *Stoichactis giganteum* off Tuticorin on the south Indian coast. Recently, *Amphiprion polymnus* (Linn.) has been recorded from the Indian coasts (Trivedi 1974). The purpose of this paper is to present the results of a field and laboratory study of the associative behaviour of *Amphiprion polymnus* and the giant sea anemone *Stoichactis giganteum*.

FIELD OBSERVATIONS

Field observations were made at Mithapur coast (69° 01′ E., 22° 25′ N.) of Gujarat. The sea anemone, *Stoichactis giganteum*, was found in depressions and crevices in littoral zone of the limestone reef among stands of living coral and seaweeds.

Its pedal disc is fastened strongly to the rocky substratum and the well-expanded oral disc is immediately retracted on disturbance. *S. giganteum* merged nicely with its surroundings of green-and-red algae and corals, and could be distinguished only on close observation.

Often one or two *A. polymnus*, of unequal size when found in a pair ,were found swimming over and about the anemone. On approach the fishes quickly entered the mouth of the anemone. The anemone, if disturbed further, immediately retracted enclosing the fishes between its tentacles. Despite the disturbance the fish, however, did not move away from its host, although the anemone was in retracted condition for a period ranging 10-15 minutes. This type of behaviour has been observed in *A. percula, A. akallopisos* and *A. perideraion* (Eibl-Eibesfeldt 1960; Mariscal 1966a, b, 1970b).

In one case the author attempted to transfer an *A. polymnus* from its original host to another individual of the same species and size; the new host was then not harbouring any symbiotic fish. In the changed condition

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also the fish showed the normal behaviour as with the former host. This supports the finding of Mariscal (1972) that there was no chemical recognition or preference by an *Amphiprion* for an anemone with which it had been living for an extended period and that any preference between two anemones of the same size, shape, colour, and species seemed to be correlated with the relative expansion of the oral disc at the time of the experiment.

Some *S. giganteum* without any symbiotic *Amphiprion* were found harbouring a pair each of symbiotic shrimps of *Periclimenes* sp. The shrimps were of unequal size and consisted generally of one male and one female (bigger than male). The presence of a berried female afforded a clue to sexual dimorphism of the shrimps present.

Laboratory Studies

Laboratory studies were conducted at Okha in a 90 cm × 45 cm × 45 cm glass aquarium with sea water, with necessary aeration facilities, using *A. polymnus* fishes collected from Mithapur and *S. giganteum* anemone from Okha coast.

In order to note behavioural pattern in the experiments the fish was introduced first. Soon after introduction the fish went straight to one corner of the aquarium and started " rocking movement " in a rhythmic manner. This movement, also described as " up and down swimming ", " bobbing ", " bouncing " and " seesawing " behaviour, consisted of rapid elevation and depression of anterior portion of the body at a fixed place. This type of behaviour is found to be more pronounced among isolated fishes, although it occurs in the fishes kept with anemones (Eibl-Eibesfeldt 1960; Mariscal 1970b). This behaviour can possibly be ascribed as an attempt to gauge the distance between shelter and approaching object, in order to facilitate easy and quick retreat.

A. polymnus also bathed in the air bubbles produced by the air diffuser stone, in the same manner as described by Mariscal (1966b, 1970b) in the case of *A. xanthurus*.

No territorial defence or agonistic behaviour was exhibited by *A. polymnus* during isolation. On introducing a pair of shrimps of *Periclimenes* sp., the *Amphiprion* quickly swam towards them, observed them cautiously and returned to its corner apparently without paying much attention.

After two days a *Stoichactis giganteum* from Okha coast was introduced into the aquarium. Mariscal (1972), commenting on the findings of Fishelson (1965), has remarked that *A. bicinctus* specimens already living with anemones would not be expected to undergo acclimation again with new anemones of the same species. Although *A. polymnus* were living with *S. giganteum* in this case, they had to undergo the acclimation with a new anemone of the same species.

For about an hour *A. polymnus* did not seem to come in contact with the anemone and remained in a corner. After that, the fishes were forcibly driven towards the anemone and they started the acclimation process, perhaps after recognition of the host. Visual stimuli are thought to be primary in the recognition of anemones by anemone fishes (Verwey 1930; Herre 1936; Gohar 1948; Davenport & Norris 1958; Mariscal 1966b, 1970b). At the start of acclimation behaviour, the fish hovered above the anemone in its typical 'up-and-down-swimming' without touching it. Then it suddenly, but cautiously, nibbled a clump of tentacles of the anemone from the side and went up. After hovering for some time it made a brief contact of the tentacles with its pelvic and

anal fins, causing a strong clinging of tentacles to the fish followed by a violent jerking back by the fish and subsequent contraction of the tentacle in typical prey-capture response. The fish repeated the process many times, gradually increasing the degree of contact and penetration of the anemone's tentacles. As a result the clinging reaction of the anemone's tentacles diminished, indicating that the fish was becoming partially protected from the anemone's nematocysts. Finally the fish began " bathing " among the tentacles, with little or no response on the part of the anemone, indicating acclimation was complete, and the guest accepted.

The time of acclimation varies with different species of anemones. In this case it took only about 15 minutes. *A. xanthurus* got acclimated to the tropical anemone *Stoichactis kenti* in about 10 minutes, to the California anemone *Anthopleura xanthogrammica* in about 1 hour, and to *Anthopleura elegantissima* (California) in about 45 hours in one instance (Mariscal 1970a).

Now the question arises as to the type of change that occurs — in fish or in anemone — which gives protection from the nematocysts to the fish. Experiments by Davenport & Norris (1958) and Mariscal (1966b, 1970a, 1971) demonstrated that it is the mucus coating of an acclimated *Amphiprion* which is responsible for the protection. They found out that, if this mucus is carefully removed, the acclimated or partially acclimated fish immediately becomes deacclimated and is stung upon every contact with the tentacles of its former anemone, though this has not been confirmed by this author.

The territorial behaviour of *Amphiprion* has been well known (as listed by Mariscal 1972). *A. polymnus* also showed this type of behaviour. It did not allow the shrimp, *Periclimenes* sp. to come near anemone. On keeping the *Periclimenes* directly between the tentacles of the anemone occupied by *A. polymnus,* the fish attacked the shrimp aggressively, chasing and driving it away from the anemone.

A. polymnus like other *Amphiprion* was also found to be an omnivorous feeder. It accepted any kind of plankton or other organic material. However, as also reported by Mariscal (1970b), once such material touched the bottom *A. polymnus* usually did not try to seize it.

A. polymnus, like other *Amphiprion* (see Mariscal 1972) also fed on waste material egested by the anemone. It was also found to nibble or tear off and ingest pieces of the tentacles of *S. giganteum.* This type of behaviour is also reported in other *Amphiprion* by Verwey (1930), Eibl-Eibesfeldt (1960) and Mariscal (1966b, 1970b). *A. polymnus* also took food to its anemone as described in other species of *Amphiprion* by many authors (Mariscal 1972).

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